The Commonwealth of Massachusetts

Department of Education

The 1994 Massachusetts Educational Assessment Program:

Description of Test Content and Reporting Categories

NOVEMBER 1993

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The Commonwealth of Massachusetts
Department of Education

350 Main Street, Malden, Massachusetts 02148-5023 • (617) 388-3300

Robert V. Antonucci
Commissioner

February 15, 1994

Dear Friends:

This document describes the content of the 1994 Massachusetts Educational Assessment Program (MEAP). For each of the subject areas included in the assessment program, a matrix is presented outlining the broad categories of content and processes tested. Sample questions and a list of reporting categories are also included.

The final administration of the MEAP will occur between March 22 and April 8, 1994. This will serve as a transition to the new assessment system established by the Massachusetts Education Reform Law of 1993. The 1994 MEAP will be substantially equivalent to the assessment administered in 1992. The only change is that tenth graders will be tested instead of twelfth graders.

The design of the new assessment system, which will be phased in over the next several years, will include such features as an annual administration, results for individual students, and the increased use of authentic measures of student performance. The new assessments will be based upon the Massachusetts Common Core of Learning, academic standards and curriculum frameworks currently under development.

If you would like any additional information about the MEAP, or the new assessment system mandated by the Education Reform Law, please call Accountability and Evaluation Services at (617) 388-3300, Extension 327.

Sincerely,

Robert V. Antonnuci
Commissioner of Education

November 1993

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Massachusetts Department of Education

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ACKNOWLEDGMENTS

The Massachusetts Educational Assessment Program would not have been possible in its present form without the generous support of many individuals and school districts throughout the state. Since its inception in 1985, four Curriculum Advisory Committees have worked to develop the assessment framework, to review the test items, to interpret the results, and to give guidance and support to the entire effort.

We wish to pay special tribute to these committee members who contributed so much to this process. We are also grateful to the school districts that supported their efforts by granting release time during the school year. The efforts of the one, the support of the other, have resulted in an Assessment program that not only reflects the values and academic aspirations of Massachusetts educators, but the most profound thinking in each of the content areas.

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Introduction

The Massachusetts Education Reform Act of 1993 requires the development of statewide goals, academic standards, curriculum frameworks and an assessment system based on the standards and frameworks. The new assessment system will be designed to measure student performance, to improve curriculum and instruction and to compare student performance among schools and districts. This new assessment will be implemented once statewide curriculum frameworks and standards are in place.

As a transition, the Massachusetts Educational Assessment Program (MEAP), established under Chapter 188 of the Acts of 1985, will be administered to all students in grades 4, 8 and 10 in the spring of 1994. The tests and their administration will be substantially equivalent to those administered in the spring of 1992.

The only change in the 1994 assessment from the previous administrations of the MEAP will be that students in grade 10 will be tested instead of those in grade 12. This change anticipates the grade 10 focus mandated by the Education Reform Law. The assessment has been modified in each content area to reflect the change to grade 10.

The 1994 Assessment Program will use a broad range of questions to test all students at the three grade levels in reading, mathematics, science and social studies. It is not intended to yield scores for individual students, but to provide highly reliable results at the school and district level.

The MEAP has been administered biennially since 1986 and has evolved to incorporate changing ideas in assessment. The general demand, by both educators and the public, for more meaningful test scores led to three changes in the 1992 MEAP. One was an emphasis on the use of proficiency levels to report on school and district scores. Although scores were still reported in terms of statewide averages, the percentage of students at each level of proficiency received greater attention. Secondly, students' ability to communicate within each of the four content areas was assessed and reported.

The third change in the 1992 MEAP concerned the increased use of open-ended (free-response) questions. These questions were evaluated for both content knowledge and ability to communicate. The results of the open-ended questions comprised 30 percent of school and district scores in each subject area. The results of the multiple-choice questions constituted the other 70 percent of the total scores. Both multiple-choice and open-ended questions were used to generate the percentages of students at each proficiency level. The 1994 assessment will continue to incorporate these changes in emphasis and approach.

This year's testing will take place from March 21 to April 8 for grades 4, 8 and 10. The assessment questions are designed to cover the subject area domains that students might be expected to learn up to and including the grade level tested. To challenge all students the tests encompass the entire range of student ability. Questions are distributed across many different test forms to provide the broad content coverage required by the assessment. Each student completes only one form. This approach, called matrix sampling, produces highly reliable results at the building and district level and minimizes testing time.

There are three parts to the MEAP: The first two consist of multiple-choice questions and the third consists of four to five open-ended questions covering the four subject areas (reading, mathematics, science and social studies). Writing is evaluated only through students' open-ended responses.

Test Development

The Assessment Program is a joint effort by the Massachusetts Department of Education, a contractor for the Assessment, and several curriculum advisory committees composed of teachers and curriculum specialists from across the state. Separate committees work on reading, science, social studies, mathematics, and writing. Initial test development in 1985-86 involved extensive work by advisory committees reviewing curriculum survey results, drafting objectives, and reviewing, revising, and selecting test questions. In subsequent years, the committees re-examined the sets of test questions, revising and rejecting questions and identifying gaps in content coverage that were then filled.

For the 1994 Assessment, new open-ended items were developed with the assistance of the committees and were field-tested in a variety of schools. In addition to reviewing the questions for content and the field test results for item quality, the advisory committees also reviewed materials to assure fairness in terms of gender and ethnic, racial, and cultural backgrounds.

The committee members advised in the construction of items included in student, teacher, and principal questionnaires. These instruments provide valuable information for the interpretation of statewide achievement results. They address such factors as program characteristics, teaching practices and attitudes.

This Report

The Assessment test questions are secure and cannot be released to local school personnel or the public either before or after test administration. For that reason, this document describes in as much detail as possible the content of the Assessment instruments at the different grade levels. For each of the four subject areas, a general development framework is discussed. These frameworks give an overview of the focus of the tests by presenting the broad categories of content and processes characterizing the subject area domains. Next, the content dimension of each subject area is described by listing concepts, ideas and skills that are included in the various reporting categories. Sample test questions are also provided to illustrate the type of reasoning that is typical of the questions used. Finally, a general description of the holistic scale in which students' written communication is evaluated is provided.

Writing

Students' ability to communicate ideas through written expression is an important indicator of their understanding. Although written communication has been considered a feature of reading, there has been increasing recognition that students must also be able to communicate in other subjects as well. The ability to structure a convincing and valid argument is certainly necessary to the area of social studies, while science and mathematics call for the ability to express and explain appropriate concepts as well as describe procedures in a way that can be duplicated by the reader.

Those open-ended questions in each content area that require an extended response will be scored holistically on a five-point scale for written communication. Students will be informed which questions will be read for communication. The features that will be considered in scoring are: topic development, organization, appropriate detail, language and sentence variety, and mechanics.

The five levels of communication are described below.

5	Richly developed topic Clear organization Details that enhance the text Effective and appropriate language Varied sentences Good control of mechanics
4	Adequate topic development Predictable organization Appropriate detail Acceptable vocabulary Predictable sentences Few errors in mechanics
3	Rudimentary development of topic Weak organization Few or inappropriate details Simplistic vocabulary Simplistic sentences Some errors in mechanics
2	Little to no development Poor organization Unfocused details Inappropriate vocabulary Many errors in mechanics
1	Insufficient text to evaluate
0	Blank, or refusal to answer

Age and grade appropriate exemplars will be used to illustrate each of these communication levels.

Student responses will be scored once for writing and once for content.

Social Studies

Framework for Social Studies

The development and selection of test questions for the social studies component of the Assessment were guided by the two-dimensional matrix below.

CONTENT AREA	PROCESS			
	Knowledge	Comprehension	Application	Higher Order
Historical Environment				
Political Environment				
Physical Environment				
Economic Environment				
Sociocultural Environment				
Process Skills				
Clarifying, Evaluating, Using Information				

The major content categories, with the exception of **Clarifying, Evaluating, and Using Information**, represent the traditional subdisciplines of social studies. The process categories represent types of mental or cognitive processing consistent with Bloom's Taxonomy of Cognitive Objectives described below. Social studies achievement will be reported to schools by each process and content category. The scores for specific content categories are based on students' responses to multiple-choice questions.

The cognitive processes represent a hierarchy of mental processes required of students in answering the test questions.

- **Knowledge** questions require primarily memory processes, such as factual recall.
- **Comprehension** questions assess the understanding of concepts and generally require students to demonstrate understanding by translating or explaining (or, for multiple-choice questions, identifying appropriate translations or explanations).

- **Application** questions require students to apply their understanding of concepts to particular situations.
- **Higher Order** questions require analysis, synthesis, and evaluation, including making judgments about the relative value of ideas by some implicit criteria. In multiple-choice questions assessing this process, several response options may often have merit, but one is clearly the best answer to the question.

The category **Clarifying, Evaluating, and Using Information** refers to critical thinking skills and is included as a content category in response to the increasing emphasis being placed on these skills in social studies instruction. For the purposes of the Assessment Program, test questions in this category focus on critical thinking skills themselves, and success in the questions is independent of knowledge or understanding of other social studies content.

To minimize the background knowledge that students must bring to the task of answering critical thinking questions, the questions themselves either provide all the information necessary or are associated with brief passages, such as explorers' journal entries, excerpts from speeches, or courtroom arguments. In this way, many of the critical thinking items resemble reading comprehension items. This is consistent with the growing recognition of the importance of reading across the curriculum — the notion that all subject-area teachers are responsible in some way for teaching students how to get information from written materials. This is not to say that social studies instruction should, at times, focus on reading or critical thinking skills in isolation. In evaluating student performance, however, it is useful to know whether poor performance is the result of a deficiency in content or in skills — e.g., whether the problem is that students are not familiar enough with the Monroe Doctrine or that they cannot identify assumptions.

If a higher order question requires an understanding of content, then it is placed in the appropriate content category (historical environment, political environment, etc.) and identified as higher order according to the process dimension. There are many such questions in the Assessment.

The following sections focus on the content dimension of the social studies framework; the sample questions clarify the meanings of the various process categories.

Grade 4 Reporting Categories — Content Dimension

		Estimated Number of Items Grade 4
I.	**Historical Environment**	**34**
	A. Specifics of History	17
	B. Sense of History	17
II.	**Political Environment**	**30**
	A. Government	15
	B. Citizenship	15
III.	**Physical Environment**	**30**
	A. Physical Geography	15
	B. Human Geography	15
IV.	**Economic Environment**	**15**
V.	**Sociocultural Environment**	**36**
	A. Social Environment	18
	B. Multicultural Environment	18
VI.	**Process Skills**	**45**
	A. Map Skills	15
	B. Graphic Representation	15
	C. Research Skills	15
VII.	**Clarifying, Evaluating, and Using Information**	**30**
	A. Analysis	15
	B. Evaluation	15
Total items		**220**

Grades 8 and 10 Reporting Categories — Content Dimension

		Estimated Number of Items Grade 8	Grade 10
I.	**Historical Environment**	**74**	**120**
	A. U.S. History	54	60
	1. Pre-1865	22	20
	2. Post-1865	17	20
	3. Contemporary Scene	15	20
	B. World History	20	60
II.	**Political Environment**	**40**	**70**
	A. Government	20	50
	1. Principles		17
	2. Components		16
	3. Processes		17
	B. Citizenship	20	20
III.	**Physical Environment**	**30**	**40**
	A. Physical Geography	15	20
	B. Human Geography	15	20
IV.	**Economic Environment**	**15**	**20**
V.	**Sociocultural Environment**	**30**	**45**
	A. Social Environment	15	23
	B. Multicultural Environment	15	22
VI.	**Process Skills**	**45**	**45**
	A. Map Skills	15	15
	B. Graphic Representation	15	15
	C. Research Skills	15	15
VII.	**Clarifying, Evaluating, and Using Information**	**36**	**40**
	A. Analysis	18	20
	B. Evaluation	18	20
Total items		**270**	**380**

Description of Content Categories — Social Studies

Historical Environment

Sample Open-Ended Item:

(picture given)
The picture at the right shows children living in the early American colonies. How were the day-to-day lives of these children like your life? (Discuss many ways that they were probably the same.)
Content: Sense of History
Process: Higher Order

Questions in this category for fourth graders will include American colonial and frontier life styles, contributions of significant persons and groups, important events, holidays of historical importance, and topics of some local/regional studies. In addition, this category will emphasize students' sense of history — ancestry, change, and connections of self/family/community to history. Attention will be given to how life styles have changed over the centuries, and the relationship between the past and the present.

Sample Multiple-Choice Items:

In the study of the Middle Ages in Europe, which of the following topics is **least** important?
A. the exploration of the New World
B. the growth of commerce and the rise of towns
C. the power and influence of the church
D. the decline of feudalism and the rise of the king-state
Content: World History
Process: Higher Order

(picture of Crusaders given)
During what time period would figures such as these have appeared?
A. 200 B.C. to 100 A.D.
B. 150 A.D. to 400 A.D.
C. 500 A.D. to 1600 A.D.
D. 1600 A.D. to 1800 A.D.
Content: World History
Process: Knowledge

At the eighth and tenth grades, questions in this category require the understanding and use of important concepts and ideas associated with various periods, eras, and themes in U.S. history. **Pre-1865** topics include the age of exploration, pre-Columbus America, colonialism and the American colonies, the making of the new republic, westward expansion, and sectionalism and division.

Post-1865 topics for the eighth and tenth grades include the growth of industrial America, urbanization, and the emergence of the United States as a world power. For both grades the **Contemporary Scene** refers to the post-1974 period and includes current events. Appropriate

attention is given to various themes such as Native American history, minority history, and significant U.S. personalities.

Sets of test questions pertaining to **World History** at grades 8 and 10 include pre-history and classical civilizations; modern world history — Renaissance to 1900; and twentieth century world history (e.g., growth of third world nations, international conflict/ideologies, technical revolution — atomic and space ages).

Political Environment

Sample Open-Ended Item:

Even though citizenship may have been granted to a particular group, history shows that many of the group's rights as citizens are achieved only piecemeal over time.

What evidence from U.S. history is there to support the statement above?
Content: Citizenship/History
Process: Higher Order

Sample Multiple-Choice Item:

Which of the following is not a legal way in which U.S. citizens may oppose laws or the actions of officials?
A. participation in boycotts
B. nonpayment of taxes
C. written letters of protest to authorities
D. recall of legislators
Content: Citizenship
Process: Knowledge

Topics covered in this category for fourth graders include the role of rules, laws, and government, basic levels of government, democratic principles, recognition and role of historical U.S. documents, significant individuals, and songs and symbols of the United States. Questions about government for eighth and tenth graders require understanding and using important concepts and ideas associated with the need for government and the origins of political principles, major historical documents as they relate to U.S. and state government, and forms of government. Tenth graders can also expect that governmental roles and responsibilities will be emphasized in questions about U.S. governmental branches and institutions. Other tenth-grade topics include questions about electoral, judicial, legislative, and executive processes.

The emphasis in the category of **Citizenship** for all grades is on the rights and responsibilities of group membership at various levels, such as school, community, and town. Also included in this category are rights and liberties guaranteed by the Constitution and important democratic attitudes and values (e.g., willingness to cooperate and participate within a group).

Physical Environment

The **Physical Geography** category at all grade levels covers topics such as place geography, surface features, climate patterns, vegetation, and natural resources. Human geography topics at all

levels include the influence of geography on various aspects of life, and humans' adaptation to, use of, and protection of the environment.

Sample Multiple-Choice Item:

One of the first discoveries that helped people settle dry regions was
A. plowing.
B. irrigation.
C. fire.
D. trading.

Content: Human Geography
Process: Higher Order

Sample Open-Ended Item:

A community has found that large quantities of hazardous chemical wastes are being left in its dump. The Environmental Protection Agency (EPA) has determined that these wastes are being produced by a large manufacturing plant within the town limits. The EPA, a state agency, and local town officials are working together to find a solution to the problem. What are three possible courses of action? For each course of action, what are some negative impacts that might result? ("Negative impacts" are unwanted effects.)

Content: Human Geography
Process: Higher Order

Economic Environment

Sample Multiple-Choice Item:

If you wanted to earn money during the winter, what could you do for a neighbor?
A. go ice skating
B. shovel snow
C. build a snowman
D. buy a new coat

Content: Economic Environment
Process: Higher Order

Sample Open-Ended Item:

In the summertime, Teri sells lemonade at a stand on the sidewalk in front of her home. This year someone else is going to open another lemonade stand just down the street from Teri's. What are several things Teri can do to make sure she gets enough customers to make her lemonade stand successful?

Content: Economic Environment
Process: Higher Order

Fundamental economic concepts covered at the fourth grade include the basics of buying and selling, simple aspects of specialization/division of labor, supply and demand, needs and wants, the role of government (e.g., services, taxes), and various ideas pertaining to personal economics. At grade 8, topics also include economic systems, factors influencing consumer purchasing power, and world economic interdependence.

Sociocultural Environment

Sample Multiple-Choice Item:

Which of the following is least likely to be found in a rural community?

A. natural resources
B. medical facilities
C. public transportation
D. shopping areas

Content: Social Environment
Process: Higher Order

Sample Open-Ended Item:

Suppose you and three other persons are given the job of building a fence around a yard. You are in charge. Describe how you would divide up tasks to get the job done efficiently.

Content: Social Environment
Process: Higher Order

At all grades this category covers aspects of social structure — the various elements of a society such as social institutions (family, religion, education) and social organization (roles of different elements — e.g., community helpers, interest groups, relationships among groups). Also included in this area is social change (how changes take place, causes and effects of change) and social problems.

At all grades aspects of **Multicultural Environments** are addressed. This category focuses on topics including cultural similarities and differences (including cultural universals such as basic needs), as well as cultural transmission and interaction.

Process Skills

Sample Multiple-Choice Item:

(map with scale given)
Approximately how far was Babylon from the Indus River?

A. 900 miles
B. 1500 miles
C. 2200 miles
D. 2600 miles

Content: Map Skills
Process: Application

Traditional **Map Skills** assessed at all levels require familiarity with maps and globes, ability to read and use maps and map legends/symbols, and understanding of scale. An understanding of coordinates and direction is also expected. **Graphic Representation** questions in this area require students at grade 4 to read and interpret information depicted graphically in social studies contexts. Different types of charts and graphs as well as time lines are included. Students at grades 8 and 10 are also expected to interpret political cartoons. **Research Skills** assessed at all grades include some

general referencing skills and knowledge of resources, and also cover problem-solving skills and data-gathering techniques typical of social studies research. Grade 10 students are also expected to develop a focus and approach for investigations and data-gathering.

Clarifying, Evaluating, and Using Information

Sample Multiple-Choice Item:

(passage provided)
Which conclusion is best supported by the evidence in this passage?

A. The employees' rights were not being respected.
B. The union officials knew best what had to be done to solve the problem.
C. The company's attorney was primarily concerned with justice.
D. Management was wrong, and labor was right.

Content: Evaluation
Process: Higher Order

The analytic skills frequently considered in the domain of critical thinking are assessed at all grades and included here. These skills require students to clarify information provided to them by identifying types of information (e.g., distinguishing fact and opinion, recognizing assumptions), essential ideas, and relationships among expressed ideas — cause and effect, time sequence of events, common characteristics (comparing and contrasting). Evaluative skills tested at all grade levels include the weighing of evidence and the drawing and evaluating of inferences based on information provided. In other words, students must use information to make judgments. The judgments might be inferences about causes of actions or events or about outcomes of actions or events, including projected outcomes. Evaluation of evidence also includes the evaluation of sources of evidence.

Reading

Framework for Reading

The development of MEAP reading tests was guided by the framework depicted below.

SKILL AREA	PASSAGE TYPE: Literary	Content	Practical
Vocabulary			
Literal Comprehension			
Inferential Comprehension			
Study Skills			

In addition to skill areas, school results in reading are reported in terms of types of passages. This reflects the fact that people read different types of materials for different purposes and use different strategies. Thus, effective reading instruction should involve variety in types of reading assignments. **Literary passages** are passages such as short stories, excerpts from larger literary pieces, poems, etc. **Content passages** are informational pieces, often from textbooks or other materials used to supplement textbook reading. **Practical passages** are such things as sets of directions, manuals, order forms, and reference tools. Authentic passages are used in all cases.

Grades 4, 8, and 10 Reporting Categories — Skill Area Dimension

		Estimated Number of Items		
		Grade 4	Grade 8	Grade 10
I.	**Vocabulary**	**15**	**22**	**27**
II.	**Literal Comprehension**	**18**	**13**	**16**
III.	**Inferential Comprehension**	**90**	**108**	**138**
	A. External Perspective	30	36	46
	B. Internal Perspective	60	72	92
	1. Analyzing Meaning	30	36	46
	2. Evaluating Ideas	30	36	46

		Estimated Number of Items		
		Grade 4	Grade 8	Grade 10
IV.	**Study Skills**	**20**	**37**	**47**
	A. Using Reference Materials		13	16
	B. Following Directions		12	16
	C. Summarizing/Organizing		12	15
Total items		**143**	**180**	**228**

Description of Content Categories — Reading

Vocabulary

Sample Multiple-Choice Items:

(passage provided)
What is the best meaning of the word ferret as it is used in the passage?
A. distribute
B. search
C. weasel-like
D. discard
Skill Area: Vocabulary—Meaning of Words from Context

Which word means to speak against?
A. addict
B. predict
C. interdict
D. contradict
Skill Area: Vocabulary—Affixes

At grade 4, the Assessment questions in this category address the traditional skills of understanding the meanings of words in context and identifying synonyms and antonyms. At grades 8 and 10, the skills tested include understanding the meanings of words in context, identifying and using affixes and roots, and drawing analogies. (Note: Analogies test verbal reasoning requiring higher-level thought processes whereas traditional vocabulary questions assess isolated word meanings. A few analogy questions are used at grade 4, and the emphasis on this type of question increases with grade level.)

Literal Comprehension

This category is not broken down further because, in a testing situation, multiple-choice questions addressing literal comprehension tend to cover the same skill — locating specific information in a passage.

Inferential Comprehension

The objectives covered in this area represent current theories that stress reading as an interactive process in which readers use their prior knowledge to make sense of the text. The two major categories of inferential comprehension reflect the different metacognitive stances that a reader takes vis-à-vis the text.

Sample Multiple-Choice Items:

(passages provided for each different item)
In the third paragraph, the word *tempura* is printed in italics because it is
A. the most important word in the paragraph.
B. part of a direct quotation.
C. being used in an unusual way.
D. a word from a foreign language.
Skill Area: External—Structural Cues

This type of passage usually presents all of the following except
A. conflicting opinions.
B. extensive technical jargon.
C. eyewitness accounts.
D. facts and statistics.
Skill Area: External—Associate Genre with Characteristics

The first paragraph of this passage makes you believe the passage will
A. present opposing views on the issue.
B. express the author's view and present evidence for that viewpoint.
C. poke fun at those who believe in Ogopogo.
D. criticize those who doubt Ogopogo's existence.
Skill Area: External—Make Predictions about Types of Information

Why did the author ask the question, "If a great many of the leaders were from the poorer classes, what kind of clue might that give us?" The author
A. wanted to vary the sentence type to make the material more readable.
B. wanted to introduce the idea that the revolutionary leaders were from the poorer classes.
C. wanted the reader to know that much about history is still not known.
D. wanted the reader to pause and think about the answer to better understand the material.
Skill Area: External—Self-checking

Questions under **External Perspective** do not refer to the actual meaning of the text, but rather to its external, formal features, such as genre and format. This category also covers understanding the approaches for different types of reading materials. For example, questions in this category refer to the purpose of structural and organizational cues (headings, italicized words), the characteristics of different types of genres, and the identification of author's purpose, point of view, and tone. Also tested are the ability to select and evaluate different reading strategies and to evaluate the relevance of prior knowledge and sources.

Sample Open-Ended Item:

A newspaper article is entitled, "Lake Champlain's Monster — Fact or Fiction?" The first two sentences of the article are:

> Believers say the warm waters of summer bring the demon to the surface. Skeptics suggest the dark dragon responds better to the ringing of cash registers.

Describe in detail the kind of information you expect the rest of the article to contain.
Skill Area: External—Make Predictions about Types of Information

Internal Perspective, which is concerned with the meaning of a text, is subdivided into two categories that represent different types of inferential activity: Analyzing Meaning and Evaluating Ideas.

Analyzing Meaning is comparable to what some reading experts call "constructing meaning." It refers to the processes readers follow as they progress from initial understanding through final interpretation. Questions in this sub-category ask students to:

- Distinguish fact from opinion.
- Recognize inferences and/or conclusions (including generalization, predictions, and deductions).
- Recognize assumptions.
- Identify causal relationships (cause and effect both stated).
- Identify similarities and differences (compare, contrast, categorize).
- Recognize ambiguity and equivocation.
- Associate reasons with conclusions.
- Recognize analogies.
- Identify main ideas.
- Summarize.

Sample Multiple-Choice Item:

(passage provided)
After Ooka explained his unusual verdict, the shopkeeper probably felt

A. satisfied.
B. bored.
C. humiliated.
D. relieved.

Skill Area: Internal Evaluation—Inferences about Effects

Sample Open-Ended Items:

(passages provided)
Explain how Antoine Parmentier's plan reveals his understanding of human nature.
Skill Area: Internal Evaluation

After reading the excerpt from *Deliverance*, what conclusions can you draw about the type of person Lewis is? Use specific details and evidence from the passage to support your response.
Skill Area: Internal Evaluation

Questions in the sub-category **Evaluating Ideas** require students to shift to a more critical stance as readers go beyond the process of understanding the author's meaning to examining and evaluating the ideas themselves. Questions in this sub-category ask students to:

- Identify propaganda/bias.
- Evaluate expertise/reliability of sources.
- Assess quality of information.
- Evaluate evidence/inferences of author and characters.
- Draw and evaluate inferences about causes.
- Draw and evaluate inferences about effects.
- Make and evaluate generalizations (including identifying theme).

Study Skills

Sample Multiple-Choice Items:

(index provided)
On what page would an explanation of soil erosion begin?
A. 97
B. 98
C. 100
D. 106
Skill Area: Study Skills—Using Reference Materials/Parts of Books

(passage provided)
I. Object of Game
II. Positions
A. Offensive
B. Defensive
III. _____
IV. Appeal of Game
An incomplete outline of the passage is shown above. What heading would be most appropriate for III?
A. Penalties
B. Strategies
C. Required Equipment
D. Popularity of Sport
Skill Area: Study Skills—Summarizing/Organizing

Assessment questions address the skills of **Using Reference Materials** (e.g., dictionary, table of contents), **Following Directions**, **Classifying and Categorizing** (at grade 4), and **Summarizing and Organizing** (at grades 8 and 10). Other questions address students' self-monitoring skills, such as asking how they check for understanding or how to clarify directions.

Mathematics

Framework for Mathematics

The mathematics component of the Assessment was developed according to the content-by-process matrix below.

CONTENT	PROCESS			
	Conceptual Understanding	Procedural Knowledge	Problem Solving	Reasoning & Analysis
Numbers and Numeration				
Operations				
Variables and Relations				
Measurement and Geometry				
Problem-Solving Skills				
Probability and Statistics				

While the narrative in the next section details the content dimension, the sample items illustrate the kinds of questions that might be asked in the various process categories. These process categories reflect the types of mathematical thinking described in the *Curriculum and Evaluation Standards* (1989, National Council of Teachers of Mathematics).

Test questions assessing students' **Conceptual Understanding** in mathematics reveal their abilities to label, verbalize, and define the concept; recognize and generate examples and non-examples; use models, diagrams, and symbols to represent the concept; translate from one mode of representation to another; and compare, contrast, and integrate related concepts.

Procedural Knowledge questions demonstrate abilities to execute procedures and verify their results; verbalize and give reasons for the steps in a procedure; recognize correct and incorrect procedures; generate new procedures and extend or modify familiar ones; and recognize situations in which a procedure is appropriate or necessary and correctly apply it.

To demonstrate their ability to use mathematics for **Problem Solving**, students are asked to recognize and formulate problems; solve problems by selecting and using appropriate strategies, models, and relevant mathematical content; and verify and generalize solutions.

The assessment of mathematical **Reasoning and Analysis** requires students to use standard forms of reasoning such as inductive, deductive, and statistical inference; apply contextual reasoning such as proportional and spatial reasoning, and abstract commonalities; specify properties and relationships; and identify the underlying structure of a situation. Sample questions in the next sections should help to clarify the meanings of these processes further. Students are expected to communicate clearly in all areas of mathematics.

Grades 4, 8, and 10 Reporting Categories — Content Dimension

		Estimated Number of Items		
		Grade 4	Grade 8	Grade 10
I.	**Numbers and Numeration**	**33**	**30**	**39**
	A. Numeration	18	15	19
	B. Number Theory	15	15	20
II.	**Operations**	**41**	**84**	**88**
	A. Whole Numbers	21	17	26
	B. Fractions (and Decimals at grade 4)	16	15	16
	C. Decimals		15	16
	D. Percent		15	15
	E. Integers		10	15
	F. Properties of Operations	4	12	
III.	**Variables and Relations**	**15**	**21**	**60**
	A. Algebraic Manipulations			20
	B. Relations/Functions			20
	C. Equations/Inequalities			20
IV.	**Measurement and Geometry**	**65**	**75**	**98**
	A. Using Instruments	15	15	15
	B. Units	15	15	20
	C. Perimeter, Area, Volume	5	15	20
	D. Plane/Solid Figures	15	15	25
	E. Transformations/Spatial Visualization	15	15	18
V.	**Problem-Solving Skills**	**36**	**45**	**48**
	A. Estimation and Reasonableness	12	15	16
	B. Strategies	12	15	16
	C. Relevant Information	12	15	16
VI.	**Probability and Statistics**	**30**	**30**	**47**
	A. Probability	15	15	15
	B. Statistics			15
	C. Graphs, Tables, Charts	15	15	17
Total items		**220**	**285**	**380**

Description of Content Categories — Mathematics

Numbers and Numeration

Fourth-grade topics and skills in this category include understanding place value, understanding number order, translating pictures to numerals, rounding to the nearest ten, using the number line, and recognizing simple fractional parts. Topics at grade 8 include those at grade 4 plus common, decimal, and equivalent fractions and mixed numerals. Grade 10 topics also include integers, irrational numbers, and scientific notation.

Sample Multiple-Choice Items:

What fraction is shown by the shaded part of the circle?

A. 1/2
B. 2/1
C. 2/3
D. 3/2

Content: Numeration
Process: Conceptual Understanding

Which number is between .04 and .05?

A. .005
B. .03
C. .045
D. .45

Content: Numeration
Process: Conceptual Understanding

Grade 4 **Number Theory** topics include number sequences, odd and even numbers, prime numbers, and common multiples (e.g., counting by threes and fives). Additional topics at grade 8 are factors and denominators, and divisibility is included at grade 10.

Operations

For all grades, assessment questions about whole numbers in this category cover computation as well as story problems.

Fraction items at grade 4 include addition and subtraction of simple fractions, computations involving money, and story problems requiring these skills. At grades 8 and 10 additional topics include all operations with fractions and mixed numbers, as well as ratio and proportion questions at grade 10. At grades 8 and 10, questions addressing **Decimals** involve computation and story problems, with an emphasis on consumer problems involving money.

The topic of **Percent**, covered at grades 8 and 10, involves understanding the concept of percentage and completing consumer-oriented story problems pertaining to such things as sale price, interest, tax, etc.

Questions concerning **Properties of Operations** at the fourth grade stress the understanding and application of properties, such as the commutative and associative properties, and concepts of operations (e.g., multiplication as repeated addition). Additional topics covered at grades 8 and 10 include distributive properties and elements of a number system (e.g., additive inverse, identity element of multiplication).

Sample Open-Ended Item:

Write a story problem that could be solved by the computation below.

$$\begin{array}{r} 12 \\ \times\ 4 \\ \hline 48 \end{array}$$

Content: Operations—Whole Numbers
Process: Reasoning and Analysis

Sample Multiple-Choice Item:

Fred wrote this subtraction exercise on his paper:

19.1 — .09 = 19.01

His teacher marked it wrong. Which of the following best explains why it was marked wrong?

A. Fred does not know his basic subtraction.
B. Fred does not understand decimal places.
C. Fred does not know the rule for "borrowing" in subtraction.
D. The teacher made a mistake; Fred's answer is correct.

Content: Operations—Decimals
Process: Procedural Knowledge

Variables and Relations

Questions in this category at all grade levels deal with such things as solving number sentences (including missing addends/factors), translating pictures to number sentences and vice versa, and determining and applying a rule (e.g., function machines). Other topics included in this category involve such things as simple substitutions, solving simple equations and inequalities, and understanding coordinates/ordered pairs and graphic representation of relations and solution sets.

Grade 10 also includes **Algebraic Manipulations**. Skills assessed in this category include:

- simplifying algebraic expressions;
- factoring;
- substituting;
- using the concept of functions;
- graphing functions (linear, quadratic, higher order);
- direct and inverse variation;
- translating verbal problems into algebraic equations of expressions;
- interpreting (meaning) of algebraic expressions.

Sample Multiple-Choice Item:

The following formula can be used to determine the cost of hiring a band:

$$C = 75 + 20h$$

where C is the total cost and h is the number of hours the band plays.

According to this formula, how much more does the band cost for every individual hour?

A. 95
B. 75
C. 55
D. 20

Content: Relations/Functions
Process: Conceptual Understanding

Sample Open-Ended Item:

Sample:

x	y
0	1
1	2
3	□
4	5
6	7

The missing number:_____
What you do to x to get y:_____
The equation:_____

Now try this one:

x	y
0	1
2	5
4	□
7	15
9	19

The missing number:_____
What you do to x to get y:_____
The equation:_____

Content: Relations and Functions
Process: Reasoning and Analysis

Measurement and Geometry

Sample Multiple-Choice Item:

What is the area of the shaded figure?

A. 10
B. 12
C. 13
D. 16

Content: Perimeter, Area, Volume
Process: Conceptual Understanding

Sample Open-Ended Item:

(illustration provided)
Jerry has a package to wrap. It has the dimensions shown at the right. The knot and bow require 10 inches of ribbon, and the package is tied with ribbon all the way around as shown. How much ribbon is needed?

Content: Operations—Whole Numbers
Process: Problem Solving

At grade 4 questions about the use of instruments in this category cover knowledge of appropriate instruments for particular situations and reading of instruments. At grades 8 and 10, the topics are the same but greater precision is expected.

The topic of **Units** is covered at grade 4 through items about the recognition of appropriate metric and English units for measuring various quantities (e.g., distance/length, weight), recognition and use of unit equivalents, and the relationship between measurement (quantity) and size of measurement unit. At grades 8 and 10 problems requiring scale drawings and proportional reasoning are included.

Perimeter, Area, and Volume questions at grade 4 involve area via unit square coverings and perimeter as distance around a figure. Additional topics at grades 8 and 10 include perimeter and area of familiar figures and irregular shapes that can be partitioned into regular shapes, volume as unit cubes, and volume of rectangular solids. Plane and solid figure items at grade 4 cover the recognition of simple plane and solid figures, as well as knowledge and use of their properties. At grades 8 and 10, additional topics include angles and angle measures, and intersecting and parallel lines.

Transformations and Spatial Visualization questions in this category at all grades involve visualizing cross sections and networks of solid figures, understanding reflections and symmetry, and identifying congruent and similar figures.

Problem-Solving Skills

In this category, items at all grade levels test skills of estimating and assessing whether an option or outcome is reasonable, using both computation and story problems. Questions addressing whether an answer is reasonable present problem situations with incomplete information and give numerical answer options differing by vast amounts.

Sample Open-Ended Item:

Explain in words how you would estimate 29 X 310. Then tell what your estimate would be.
Content: Estimation
Process: Conceptual Understanding

Sample Multiple-Choice Item:

What would help most to solve the problem in the box?

Julie and Joe are standing 10 feet apart. How many spots are there that are 15 feet from each of them?

A. using an equation
B. drawing a diagram
C. guessing, then testing
D. making a table

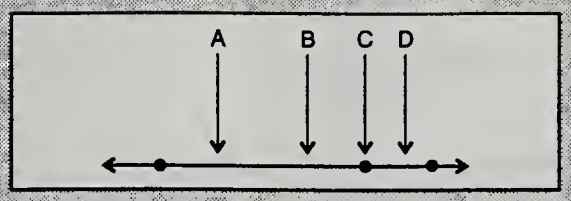
Content: Strategies
Process: Problem Solving

Strategy questions at all grade levels ask students to identify the appropriate number sentences, operations, or diagrams one might use to solve problems. Others ask the students to determine or complete the next step in a strategy already being applied to a problem situation. **Relevant Information** questions ask students to identify the information that is missing or not needed to solve story problems.

Probability and Statistics

Probability and Statistics questions in this category at grade 4 deal with informal probability (e.g., spinner problems with probability related to areas of regions) and simple permutations and combinations. Additional topics at grades 8 and 10 include the computation of exact probabilities, and the meaning and computation of averages. Statistics questions at grade 10 deal with the meaning and determination of measures of central tendency (average), the meaningfulness of different statistics depending on the situation and variable in question, and other aspects of data reduction or simplification.

Sample Multiple-Choice Items:



The three dots above represent numbers on a number line. Which arrow points to the average of the three numbers?

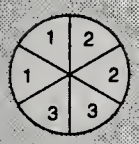
A. Arrow A
B. Arrow B
C. Arrow C
D. Arrow D

Content: Statistics
Process: Conceptual Understanding

A player wins at a dart game if the player throws a dart that lands in a "3" area. Which dart board below would give the player the best chance of winning?

A.


B.


C.


D.


Content: Probability and Statistics
Process: Reasoning and Analysis

Science

Framework for Science

The content sub-categories are described in the two sections that follow. The process dimension is based on Bloom's Taxonomy of Cognitive Objectives. The sample questions provide clarification of these categories.

CONTENT AREA	PROCESS			
	Knowledge	Comprehension	Application	Higher Order
Scientific Inquiry				
Life Science				
Earth/Space Science				
Physical Science				

The descriptions of the reporting categories on the following pages list important, broad concepts within the various categories.

Grades 4, 8, and 10 Reporting Categories — Content Dimension

		Estimated Number of Items		
		Grade 4	Grade 8	Grade 10
I.	**Scientific Inquiry**	**51**	**56**	**69**
	A. Designing Investigations	15	15	18
	B. Data Gathering/Reduction	16	20	25
	C. Data Interpretation	15	15	19
	D. Nature of Science	5	6	7
II.	**Life Science**	**75**	**75**	**110**
	A. Characteristics of Life	15	15	21
	B. Health	15	15	21
	C. Animal Life	15	15	22
	D. Plant Life	15	15	21
	E. Ecology and Environment	15	15	25

		Estimated Number of Items		
		Grade 4	Grade 8	Grade 10
III.	**Earth and Space Science**	**46**	**55**	**80**
	A. Astronomy	15	16	19
	B. Meteorology	15	16	19
	C. Geology and Natural Resources (and Oceanography at grades 4 and 8)	16	23	23
	D. Oceanography			19
IV.	**Physical Science**	**48**	**69**	**102**
	A. Matter	16	23	36
	B. Energy	16	23	33
	C. Force and Motion	16	23	33
Total items		**220**	**255**	**361**

Description of Content Categories — Science

Scientific Inquiry

Sample Open-Ended Item:

Chris wants to find out which of two spot removers is better. He decides to try out each of the spot removers on some stains. He tests Spot Remover A first. What are some things that should be the same when he tests Spot Remover B?

Content: Beginning Investigations
Process: Application

Sample Multiple-Choice Item:

Wanda believes that soccer players in her school tend not to take music classes as much as other students. What information should she compute to test her hypothesis?

A. the average number of soccer players and music students per year
B. the number of soccer players and number of non-soccer players taking music
C. the average grades of soccer players in music
D. the percentage of soccer players and percentage of non-soccer players taking music

Content: Data Gathering/Reduction
Process: Application

In the category of **Designing Investigations,** students are expected to identify the best step or sequence of steps to investigate a problem or answer a question, identify significant questions in solving a problem, recognize relevant variables, and understand the notion of a sample representing a larger group. In the eighth and tenth grades, students are expected to identify testable hypotheses, match hypotheses to research questions and to most appropriate designs, understand the importance of control of variables in experimentation, and recognize independent and dependent variables.

In the area of **Data Gathering and Reduction**, students should be able to determine the best method to collect information in a situation; identify appropriate instruments; sort and order data; make observations; and recognize appropriate ways of displaying information for given purposes. In addition to those topics, eighth graders are expected to be able to recognize good and poor sampling, understand measurement and measurement error, and produce appropriate graphs, tables, etc. Grade 10 students are also expected to recognize the appropriateness of frequency counts, averages, cross-tabulations, and other summary/descriptive statistics and methods of displaying data.

Under **Data Interpretation**, all students are asked to demonstrate the ability to read and interpret graphs and tables, draw and evaluate conclusions from data, identify strongest evidence of a conclusion, and generalize to the appropriate level. Eighth and tenth graders are additionally expected to be able to generate models, and tenth graders are expected to be able to use inductive logic.

Questions about the **Nature of Science** require students at all grade levels to understand the purposes and roles of science in society, and the characteristics of scientific activity (e.g., science is not exact, knowledge changes).

Life Science

Topics covered in the category of **Characteristics of Life** include classifications of living things, basic life functions, organization of living things, and life cycles/stages. Additional topics for eighth and tenth graders include concepts of genetics and heredity, and concepts of evolution.

Health topics included in the Assessment are nutrition, substance abuse, personal hygiene, and health maintenance. Eighth and tenth graders are also expected to understand diseases (causes, characteristics), and human reproduction (birth control, sexually transmitted disease).

Animal Life topics covered at all grade levels include characteristics of the more familiar classifications of animals, functions and interaction of organs and systems, and animal behavior. Tenth graders are also expected to be familiar with microorganisms.

Plant Life topics at all grade levels include the characteristics of more familiar classifications of plants, functions of plant parts, and the requirements and products of photosynthesis.

Sample Multiple-Choice Item:

Which of the following is most likely to contaminate the drinking water in a well in a family's back yard?

A. planting a vegetable garden nearby
B. fertilizing the lawn
C. throwing rocks into the well
D. building a tool shed nearby

Content: Ecology and Environment
Process: Higher Order

Sample Open-Ended Item:

Large numbers of dead fish, all white perch, have been found along the shore of the Quabbin Reservoir. Other fish species have not been dying. Give two possible hypotheses explaining these findings. Describe how each hypothesis might be tested.

Content: Ecology and Environment
Process: Higher Order

In the area of **Ecology and the Environment**, topics covered are predator/prey relationships, food chains, disruptions of ecological balance, habitats, and cycles. Eighth and tenth graders are also expected to understand food pyramids and population growth and stability, and to be familiar with carbon and nitrogen cycling.

Earth and Space Science

Sample Multiple-Choice Item:

Which of the following events probably occurred first in the earth's early history?

A. formation of the earth's molten core
B. formation of the continents
C. condensation of clouds into rain
D. eruption of volcanoes

Content: Geology
Process: Comprehension

Sample Open-Ended Item:

The moon orbits the earth. Explain why the moon does not fall to earth.

Content: Astronomy
Process: Comprehension

Astronomy topics covered at all grades include components of our solar system, space exploration, and the relative positions and motions of the earth, moon, and sun.

Aspects of **Meteorology** addressed in the Assessment are weather characteristics, weather instruments, and the water cycle. Additional topics at grades 8 and 10 include weather prediction and change, and climate.

Geology, Natural Resources, and Oceanography topics at grade 4 include earth, land forms, changes in the earth's surface, natural resources, characteristics of ocean environment(s), habitats and

life forms, and ocean movements. Topics in this category at grades 8 and 10 include geologic time, plate tectonics and the rock cycle, chemical and physical characteristics of the ocean, and marine geology.

Physical Science

Sample Multiple-Choice Item:

In which device is the most important energy change a conversion of heat energy into mechanical energy?

A. electric motor
B. steam engine
C. light bulb
D. clothes dryer

Content: Energy
Process: Higher Order

Sample Open-Ended Item:

(picture of dynamo provided)
A girl has a dynamo on her bicycle to light her lamps. She notices that when the dynamo is being used it is harder to pedal at the same speed. She is told this is because energy cannot be created nor destroyed, only changed from one form into another.
How does this explain what she has noticed?

Content: Energy
Process: Comprehension

Chemistry concepts covered include characteristics of **Matter** — density, states of matter, types of matter, and physical and chemical changes. Additional concepts covered at grades 8 and 10 include additional characteristics of materials (conductivity and magnetic properties), conservation of matter, structure and types of matter, and gas laws. Radioactivity, magnetic properties, periodicity, reactions, and fission and fusion are all additional grade 10 topics.

Energy topics include light, sound, electricity, heat, and magnetism, as well as conductivity, energy conversion, and techniques of energy conservation. Grades 8 and 10 topics include waves and optics, heat transfer, circuits, and electrical components.

Concepts of **Motion** and mechanics covered are basic concepts and quantities, laws of motion, and simple machines. Eighth and tenth graders are expected to have some basic understanding of such concepts as resultant (vector) forces and gravitational forces.